

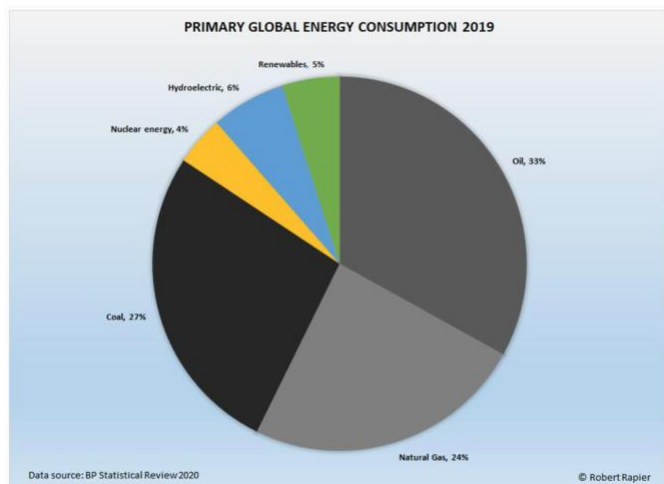
# eCards

## Research Topic Oil and Gas

### Oil and Gas

In Canada, many of the things we take for granted in our day-to-day lives run on crude oil and natural gas. Crude oil meets most of our transportation needs by fueling cars, buses, trucks and planes. Natural gas is the biggest source of heat for our homes and businesses. Many of the products we use every day — including all plastics, many household products and some clothing — are by-products of oil and gas.

Canada's reliance on crude oil and natural gas is not unusual. Today, 57% of the world's energy supply comes from oil and gas.



The world's use of crude oil and natural gas continues to make headlines and to raise important questions: What are the costs and effects of our reliance on oil and gas? Do we have enough supply of

these vital resources? How can we conserve energy? What other energy sources can we use? Our answers to these questions will be central in shaping our energy futures.

Crude oil and natural gas are the fossilized remains of ancient plants and animals. Hundreds of millions of years ago, areas of Canada were a warm, shallow sea teeming with life. For several million years, deep layers of sand, silt and mud accumulated, rich in the remains of plants and animals that lived in the water. These layers eventually became sedimentary rock with the matter from dead organisms trapped inside. Over time, heat and pressure transformed this organic matter into crude oil and natural gas.

Crude oil is a smelly, black fluid, a lot like cooking oil in consistency. Some deposits are more than two kilometres below the surface of the Earth! Natural gas, which is a mixture of gases, is often found in the same areas as crude oil, trapped in layers of porous rocks deep below the Earth's surface.

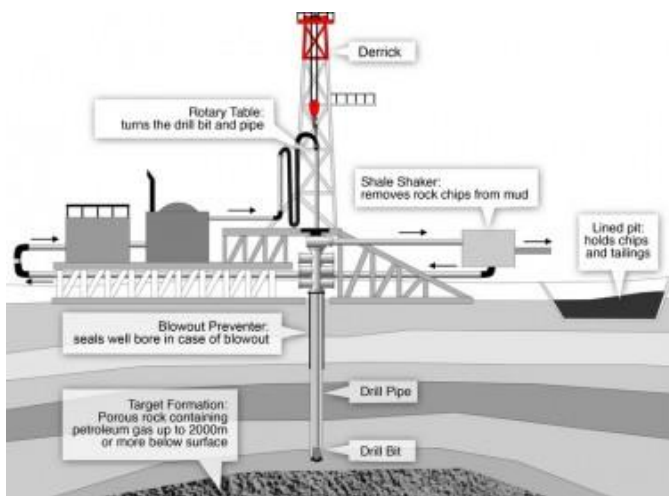
Both crude oil and natural gas are sometimes referred to as *petroleum* and, along with coal, as *fossil fuels*. Crude oil and natural gas are often also referred to simply as *oil and gas*. When talking about oil, people also distinguish between *conventional* sources, such as crude oil, and *non-conventional* sources, such as oil sands.

## How Do Crude Oil and Natural Gas Become Energy for Human Use?

Deposits of crude oil and natural gas are found in many parts of the world. In Canada, they are primarily found in the Western Canada Sedimentary Basin, a vast 1,400,000 square kilometre area that includes all of Alberta and parts of Manitoba, Saskatchewan, British Columbia and the Northwest Territories. Oil and gas reserves are also found off the Atlantic coast in an area known as *Hibernia*.

People began drilling for crude oil and natural gas in Canada 150 years ago. Canada now plays a major role in the production and export of crude oil and natural gas. Today, oil and gas companies use the latest scientific techniques and many millions of dollars to explore and drill for oil.

To reach deposits, a drilling rig is used to bore a hole down through the upper layers of the Earth's crust to get to the scattered crude oil deposits that are found in the layers of porous sedimentary rock.



Once a productive well has been established, crude oil can be pumped to the surface with the help of a **pump jack**. A pump jack works like the lift pump of an old-fashioned water well. While gas must be pumped, natural gas usually flows to the surface under its own pressure.

Canada's crude oil and natural gas are usually shipped to refineries and processing plants in underground

pipelines. To build a pipeline, workers weld together long sections of pipe called **joints** and bury them in deep trenches. Each pipeline has a series of valves that allow operators to shut down the flow of product.

At the refinery, crude oil is separated into different parts through various processes. Many products are then extracted.

In the processing plant, many products are made from raw natural gas:

<b>Methane</b>	For furnaces hot water heaters, gas driers, stoves, barbecues, and gas fireplaces
<b>Ethane</b>	For polyethylene plastic which is the base of all of our plastic products
<b>Propane</b>	For barbecues and some cars
<b>Butane</b>	For small appliances camp stoves and lighters

After being processed, natural gas travels to farms, homes, and businesses in smaller pipelines. Oil gets transported from the refinery in trains and trucks.

When oil and gas products are burned to supply us with energy such as in a car engine, furnaces, barbecues, lawnmowers, or hot water heaters, for example, they emit greenhouse gases such as carbon dioxide into the atmosphere. Natural gas produces less carbon dioxide than crude oil, and crude oil produces less than coal. Coal is by far the dirtiest of fossil fuels.

As non-renewable sources of energy, oil and gas are limited in supply. World peak oil is the phrase used to describe the point in time when the world is extracting oil and gas at its maximum rate. After that point, the rate of production will begin to slow down.

The latest research suggests that we will soon reach the peak of historic world production of crude oil and natural gas. Supplies will still remain, but they will dwindle as time passes.

It is difficult to know when peak oil will be reached: some experts say it will happen around 2030; others say it has already started. Even as the world reaches peak oil, the production and consumption of oil and gas will be essential in Canada for many decades to come.

## What are the Advantages and Disadvantages of Our Use of Oil and Gas?

Our current and future use of crude oil and natural gas is at the centre of many energy debates. As sources of energy, oil and gas have real advantages and disadvantages.

### **Advantages:**

- Crude oil and natural gas contribute greatly to our lifestyles — by allowing for car and air travel, for example, and a world full of plastics.
- Historically, crude oil and natural gas have been abundant and affordable sources of energy for Canadians.
- Canada is a big player on the world stage in the production of oil and gas. The production of these resources in Canada has helped the economy expand and thrive and has employed thousands of Canadians — from the scientists who search for oil deposits to people that build and install pipelines to the gas station attendant who fills our gas tanks.
- The raw material and finished products of crude oil and natural gas can be transported fairly easily to and from refineries and processing plants.
- New reserves of crude oil and natural gas are still being opened for production in places such as under the sea and in the Arctic. Exploration in unconventional oil and gas is still expanding — into oil sands and coal-bed methane, for example.
- Supplies of natural gas are not running out as quickly as supplies of crude oil.
- Natural gas burns more efficiently and cleanly

than crude oil and coal, but it is less concentrated (170 cubic metres natural gas = 1 barrel of oil).

- Power stations that burn natural gas can be built almost anywhere.

### **Disadvantages:**

- Burning crude oil and natural gas emit harmful gases such as carbon dioxide, sulphur dioxide and sulphur trioxide. These gases pollute the air. As a greenhouse gas, carbon dioxide also contributes to climate change.
- Environmental impacts also occur at many points in the production process — from exploration and drilling to the installation of hundreds and hundreds of kilometres of pipelines, and from the refining process through to the transportation of oil and gas products by rail and trucks.
- Some of Canada's exploration, drilling and pipelines have clashed with the rights and lifestyles of Aboriginal peoples.
- Crude oil and liquefied natural gas are also shipped by supertanker, and although spills are rare, their effects on wildlife and coastlines are catastrophic and long-lasting. Accidents can also happen with pipelines: they can leak or burst, spewing oil or natural gas into the environment.
- Because we are using up the world's supply of crude oil and natural gas, they will not be available for future generations. Many workers and the investment in exploration, rigs and pipelines will have to be redirected.
- Although investment in new technologies has found new and non-conventional sources of oil, many are in sensitive regions such as wildlife refuges (in the Arctic, for example) and are especially costly to the environment to produce (the oil sands, for example).
- Although Canada has a good supply of crude oil and natural gas, we have to rely on some imports to meet our fuel needs. As supplies of oil and gas dwindle and demand increases, we can expect more price hikes and more strain on foreign relations.
- Crude oil and natural gas produce a number of waste products, many of them toxic.

## What Role Will Crude Oil and Natural Gas Have in Our Energy Future?

The question of what role crude oil and natural gas will play in our energy future is a complex and important one.

Most scientists and other experts agree that we need to reduce our dependence on crude oil and natural gas. Why? We need to pollute less. We also need to depend less on any one source of energy, especially since we know that these non-renewable resources will eventually run out.

How do we reduce our reliance on oil and gas? Some say the solution is to be found in technology. Better technologies could make fuels cleaner, and vehicles such as airplanes, trains and cars much more fuel-efficient. New technologies could also get at deposits of crude oil and natural gas that have been too expensive or difficult to access. This solution would have the least impact on the many Canadians who work in the oil and gas industry.

Others say that the solution lies in turning to new and cleaner sources of energy. If Canada would invest money in renewable energy sources such as wind and solar at the same rate as it invests in crude oil and natural gas, renewable energy could quickly become more available and more affordable, and many new jobs could be created in the process.

In the current debates about energy, others say we need to re-think the very way we live. Can we find ways to significantly reduce our energy use? Can we educate Canadians to conserve energy and give them economic reasons to do so? Can we learn to live differently, in ways that are more sustainable for the planet?

There are no easy answers to questions about the future of crude oil and natural gas. We will surely need to rely on a combination of many solutions. For example, we will certainly need to rely on both non-renewable and renewable energy sources for many decades to come. What will our energy mix look like in five years or twenty-five years? What will it mean for Canadians, our environment and our economy?

## Oil & Gas Fact Sheet

### Global Facts

- In many cases, the countries that consume the most oil are not the ones that produce the most.
- Recently, the global growth in energy demand has been led by developing countries, especially China and India.

### Canadian Facts

- Canada is the fourth-largest producer and third-largest exporter of oil in the world.
- 97% of Canada's proven oil reserves are located in the oil sands.
- 98% of Canada's oil exports go to the U.S.
- GHG emissions per barrel of oil produced in the oil sands have fallen 36% since 2000.
- More than half of the energy used by Canadians comes from oil and gas: 33% of our use is oil and 24% is gas.
- On average, every Canadian uses about three tonnes of oil equivalent each year, making Canadians some of the biggest per person consumers of oil in the world.
- Using all that oil and gas per person also makes Canadians some of the biggest emitters of greenhouse gas pollution.
- Canada is the fourth-largest producer and sixth largest exporter of natural gas
- Alberta contains about 80.5% of Canada's total natural gas production.

### Crude Oil in Canada, 2019 (MMb/d = million barrels per day)

- Canadian production: 4.7 MMb/d
- Imports: 0.8 MMb/d
- Exports: 3.8 MMb/d
- Crude oil shipped to domestic refineries: 1.7 MMb/d

## Natural Gas in Canada, 2019

In 2019, Canada-U.S. production in the natural gas industry reached 108.8 billion cubic feet per day (Bcf/d) or 3.1 billion cubic metres per day (Bcm/d).

- Canadian average marketable production: 16.6 Bcf/d (0.5 Bcm/d)
  - Conventional: 14%
  - Unconventional\*: 86%
- U.S. average marketable production: 92.2 Bcf/d (2.6 Bcm/d)
  - Conventional: 13%
  - Unconventional\*: 87%
- LNG imports of North American countries:
  - Canada: 0.05 Bcf/d
  - U.S.: 0.16 Bcf/d
  - Mexico: 0.66 Bcf/d
- LNG exports of North American countries:
  - U.S.: 5.76 Bcf/d

*\*Unconventional gas includes tight gas, coalbed methane and shale gas*